

# Homework 7

## *Ma641 Time Series I*

due by 11:45pm, August 21, 2009

This is the final assignment that also counts as the Final Exam. You have ample time to finalize this assignment. Please note: For the problems using data I am not interested in all the little steps you perform. You need to write a final report. You also need to argument with plots or selected numerical results all the conclusions you draw. Please add supporting arguments (output in the appendix). **The final write-up (excluding the appendix) should not be more than 10-15 pages.**

**Problem 1: Theory (100 points)** For this part please solve the problem 4.3 on page 201 and the problem 8.5 on page 401 in the textbook. Should you desire, you may use pen and paper for this part and hand in this part directly to me, or scan the papers and include with the rest of the assignment.

**Problem 2: Application (200 points)** Use the five stocks data that was used in *lecture10.r* file as inputs for a neural network. Use the three indices attached to this file as outputs (either separately or together). Divide the data into two parts (however you wish) one for training and one for evaluating the constructed networks. Use as many hidden nodes as you like. On August 12 at close download the relevant data from the yahoo finance website and evaluate your predictions. Answer the following questions:

1. Which of the three indices was best replicated?
2. Repeat the analysis but now use as inputs the current day stock values *and* the current day index values and as outputs the next day index values. Evaluate this model again on August 12.

3. Now look at just the buy sell indication of the model (i.e., if the model predicts a higher value for index XXX on August 11 than the predicted value on August 10 -positive return - that means you obtained a buy signal on August 10). How many times was the model correct?
4. Suppose you have a 1 million dollar account. Start trading in any of the indices you want (or a combination of them) according to the signals obtained from the previous part. Use actual values and neglect transaction costs. What is the value of your portfolio at close on August 12?
5. Finally, repeat the neural network analysis every day at close to obtain a buy sell signal for the next day for the period August 5 – August 12. Then trade according to the signal and use the Open Close quotes for each day. What is the value of your portfolio now? How does it compare with the one obtained at the previous point?

**Problem 3: Bonus problem (100 points)** The Bonus problem is here to help the people who are willing to work to obtain a better grade.

For this problem use the minute data provided in the midterm. Divide this data into two parts: One containing the majority of the data minus the last 180 observations (the last three hours on Friday). Construct the best model you can using the first part of the data. Evaluate and chose one of these models using the next 120 observations (2 hours on Friday). Finally, using this best model predict the 60 observations for the last hour on Friday. Look at the predicted data series. At the moments when the predicted data series has local minimum buy and at the local maximum sell. Use the real 60 observations and a 10,000 dollar fund. Use the high and low within the minute to do so. Use transaction costs of 0.003% of the transaction value.

What is the value of your portfolio at the end of the hour? What is the profit/loss?

Note: I would pay special attention to what happens during the last hour in the rest of the other days and especially on the previous Friday.